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cators, however, were not aware of the fact; others caught half-glimpses of the movement and stubbornly—shall we say blindly?—resisted it. He perceived the impending revolution and unhesitatingly cast his influence on the side of the new régime. It was evident that, with the development of scientific research in many branches, with the quickening interest in historical studies and economics, in the fine arts, and in modern languages—that under these circumstances the old hard and fast curriculum was bound to break down; that it had broken down. No college could pretend to minister to the intellectual needs of mankind which confined its students to the narrow round of the classics, mathematics, cut-and-dried philosophy, and a smattering of physics and chemistry. The new wine was bursting the old bottles. President Eliot dared greatly. Under a storm of criticism he boldly converted Harvard into an experimental laboratory for the application of the elective system. That experiment has not yet ended. We may not have mastered all the principles involved; we are still overwhelmed by the mass of details to be coordinated and subordinated. But whatever final results the centuries may bring, we can say now that President Eliot achieved a success which astonished his supporters and confounded his opponents.

The elective system is based on the theory that the best educational product is to be obtained only when student and teacher enjoy the widest intellectual freedom; and to this theory President Eliot has adhered with unswerving consistency. Indeed, he is often accused of pushing it to extremes. The student is allowed unrestricted range in the choice of courses; the professor's academic freedom has, as President Eliot himself once expressed it, been subject to only two limitations, "those of courtesy and honor." The president, too, has followed a liberal principle in picking his faculty. He has never shown that suspicion or dread of unusual intelligence, that predilection for mediocrity, which marks some of our heads of universities. He has selected the ablest men he could find, whether graduates of Harvard or not, and Harvard has thus escaped the blight of inbreeding which two or

three decades ago afflicted Yale so severely. And all these policies have been carried out with wonderful executive skill—with unexampled grasp of detail, with foresight, patience, steadiness and tolerance.

To find a man who can fill his place is, of course, impossible. His attention to public questions and his utterances on such subjects as labor and its rights have made him the foremost private citizen of the United States. But it will take a long time for the next president of Harvard to establish such a reputation. Even the administrative work will have to be rearranged; for the giants who can lift the load to which his shoulders have grown accustomed are few. Nor are Harvard's problems all solved. The practical application of the elective system is full of difficulties. The system has been abused at Harvard and elsewhere. Small institutions of limited resources, ambitious to present an imposing list of courses in the catalogue, have sacrificed the instruction in the old studies with well developed disciplines, in order to spread the teaching thin over a broad field. If Harvard has been able to avoid this form of enfeeblement and demoralization, it has had other forms to contend with. Committees of the faculty are still trying to devise means by which students shall not divide and dissipate their energies in too many directions, or shall not slip through college on "soft" courses and practically avoid all study. These, however, are minor matters; for if Harvard can maintain a distinguished faculty, can make the conditions of life and teaching at Cambridge so attractive as to draw to its service the finest minds and characters in America, the rest will be comparatively easy. Thus President Eliot's successor can, as the letter of resignation puts it, face "the sure prospect of greater labors and satisfactions to come."—*New York Evening Post*.

SCIENTIFIC BOOKS

Marine Engineering. By Engineer-Commander A. E. TOMPKINS, Royal Navy, Late Instructor in Steam and Marine Engineering, Machine Construction, etc., at the Royal Naval College, Greenwich, and Lec-

turer at the Royal Naval War College, etc. New York, The Macmillan Company. \$4.50.

This work the author terms a complete textbook on the construction and working of marine engines and boilers, from which it is to be assumed it does not apply to the designing, as the information on the latter subject is quite limited, whereas that on construction—or what follows the design—together with care and management are very complete. He gives a very full history of the development of the steam engine from Savery in 1698 to the turbine and gas producer of to-day. Much information is given to the one wishing to practise the art of designing the different structures, but the most to those desiring to become skilled in the construction, operation and care of the marine engine, as the designing of such machinery demands a line of study outside of what can be given in a treatise of this kind.

The articles on Care and Management are particularly valuable, as they are from the author's experience of many years in charge of machinery in warships of many types in the British Navy. It is, therefore, as he states: "A summary of the best practise of the present day." In support of this let me quote from chapter 32:

The main propelling machinery is always erected in the workshops before its final erection in the ship. By this system the alignment and proper fitting of all parts are ascertained and any discrepancy remedied while still in the building stage, and usually a water-pressure test is made of cylinder jackets and other fittings in the shop. Although this preliminary building-up of the engines, only to be taken down and rebuilt, seems somewhat of a useless undertaking, experience shows that large saving in the cost of labor and better fitting and adjustment are obtained. . . . The successful working of the machinery is largely dependent upon this accuracy.

The correctness of this view is confirmed by my experience in the same line of work. The double care taken, although seemingly useless and unnecessarily expensive, has been found to be the most economical, also the one from which not only the best results are obtained, but is sure to avoid trouble and dis-

appointment. The amount of care taken is often overdone, but what the author recognizes as necessary can not be avoided if superior results are desired. This part of the book has been dwelt upon as it is one so little recognized in works treating on the steam engine, whereas the neglect to properly inspect and install this engine in the vessel has defeated success from a faultless design. The great trouble in the production of the marine engine has been the absence of the same degree of intelligence in this part of the work, builders and their workmen having too great a tendency to rush the erection in the vessel, notwithstanding the fact that the time and care taken, as well as the first expense incurred are returned a hundred-fold before the vessel leaves the builders' hands, not to say anything in reference to a better performance from the beginning of its life.

Notwithstanding the general excellence of the book, there is one view to which exception must be taken and that is about the combustion chamber in the cylindrical boiler. Here the author states it should not be common to all furnaces, but should be as numerous as the latter in order to produce better circulation so as to save the tube-sheets. This is not only a fallacy as the trouble is due to unnecessarily heavy tube-sheets, but also an evil, as it prevents proper combustion of the gases and tends to produce smoke to obstruct observation and make the presence of the ship known.

This single criticism, however, should not take from the value of the work as it abounds in so much that is good and valuable to one seeking information on the subject and desiring to be correctly informed as to the marine engine practise of to-day and the lines on which it may be extended in the future.

The field of observation and subject covered show how great has been the growth in marine engineering in the past fifty years. In this the author has not been content to treat only on what to-day is found in general service, but invades the realm of the experimenter, taking up the combination of the reciprocating engine with the turbine, as well as the introduc-

tion of the gas producer in combination with the gas engine. The result in the first case will shortly be known as the White Star Line has taken this matter up and is building a large vessel equipped with such engines. The latter subject, however, although one of great interest in view of what has been done with the internal combustion engine, seems to warrant going deeper into the subject and has led up to its consideration on shipboard in connection with supplying gas for the use of the engine. In treating of the gas producer he not only speaks of the good features, but tells of the difficulties, which are of considerable importance, one being the cleaning of the fires and the other the replenishing of the water to produce steam admitted to the fuel when the vessel is in salt water. These are subjects which the enthusiasts on the gas producer have overlooked and will have to be taken care of in its development.

The questions from examination papers at the end of the volume, although some of them are unnecessary, for the proper care and management of the marine engine, such as "Define the term 'the Latent Heat of Steam,'" there are others which will be found valuable such as "Explain how a boiler is liable to suffer from undue haste in raising steam, and describe the precautions that are necessary when steam is being raised." The man who has the care of a steam engine should know all about the management of the boiler and no doubt will attend to his duties much better if his head is not filled with latent ideas.

HORACE SEE

NEW YORK,

October 21, 1908

Gray's New Manual of Botany. A Handbook of the Flowering Plants and Ferns of the Central and Northeastern United States and Adjacent Canada, rearranged and extensively revised by BENJAMIN LINCOLN ROBINSON, Asa Gray Professor of Systematic Botany in Harvard University, and MERRITT LYNDON FERNALD, Assistant Professor of Botany in Harvard University. New York, Cincinnati, Chicago, American Book Company. Seventh edition, illus-

trated. Copyright, 1908, by the president and fellows of Harvard College.

Sixty years ago Dr. Asa Gray issued the first edition of his "Manual of the Botany of the Northern United States," which covered the region "from New England to Wisconsin, and south to Ohio and Pennsylvania inclusive." In the second edition (1856) this rather limited region was extended southward so as to include Virginia and Kentucky, and westward to the Mississippi River, and here the boundaries remained for the third, fourth and fifth editions. The sixth edition was nominally "revised and extended westward to the 100th meridian," but in fact did not include all of the plants in the large addition to its area. The westward range of the present edition terminates at the 96th meridian, and it thus includes the trans-Mississippi states of Minnesota, Iowa and Missouri, and small fractions of eastern Nebraska and Kansas.

To one who was "brought up" on Gray's "Manual," this new edition has peculiar interest, and while many changes have been made in the old book the revisers have succeeded in preserving enough of the style of treatment, and the general appearance to make one soon feel at home in the new volume. The first thing that one who knew the old manual notices is the almost complete inversion in the sequence of the families, the book now following Engler and Prantl's "Pflanzenfamilien," instead of De Candolle's "Prodromus." This brings it into harmony with most modern systematic publications in this country and Europe, and makes it much more usable than it would have been had the old sequence been continued.

Another innovation is the introduction of many illustrations (numbering more than a thousand) which help to make the specific descriptions more distinctive. These are usually selected with much care, being used only when they can certainly help the text. Thus in the grasses (*Gramineae*) and sedges (*Cyperaceae*) they are very freely used, as they are also in *Umbelliferae*.

In regard to nomenclature we are told that the editors have scrupulously endeavored to